Centers for Disease Control

ATSDR Agency for Toxic Substances & Disease Registry Public Health Assessments & Health Consultations

PUBLIC HEALTH ASSESSMENT

RUBBERTOWN INDUSTRIAL AREA
JEFFERSON COUNTY, KENTUCKY

ENVIRONMENTAL CONTAMINATION AND OTHER HAZARDS

ATSDR has summarized all monitoring data obtained for the Rubbertown site and vicinity. For the purpose of this public health assessment, ATSDR considers "on site" to refer to the Rubbertown industries and "off site" to refer to all other areas, including residences, parks, and other commercial and industrial properties not a part of Rubbertown. ATSDR received data for air, soil, sediment, and fish. Available air and residential soil data are presented in Tables 1 through 3, Appendix A. Sediment and fish data are discussed in the text. The contaminants summarized in this section are evaluated in subsequent sections of this report to the extent possible to determine whether exposure to them has public health significance. For information on ATSDR methodology, please refer to Appendix E.

A. Contamination by Medium

Air

The prevailing wind direction in West Louisville is from the southwest. The West End residential area is downwind of Rubbertown, and historically has likely been subject to the greatest amount of contamination emitted to the air by the Rubbertown industrial area. ATSDR reviewed available air monitoring data from the following three sources: (1) a "Special Air Pollution Study" conducted from 1956-1957 by various agencies, which included monitoring data from the West End; (2) the 1988 Urban Air Toxics Monitoring Program (UATMP) conducted by EPA, which included a monitoring station in downtown Louisville; and (3) annual monitoring for criteria pollutants conducted since 1980 by the Jefferson County Air Pollution Control District (JCAPCD).

The 1956-1957 Special Air Pollution Study for Louisville and Jefferson County was a collaborative effort among many local, state, and federal agencies. The air was tested for particulate and gaseous pollutants. Investigators also studied air patterns and conducted a "source inventory," estimating the total pounds of pollutants (fossil fuel and solvent vapor emissions) from industrial and domestic sources.

Two important things should be kept in mind when interpreting data from the 1950s study. First, air quality was monitored in the West End , which is located downwind of Rubbertown during "acute pollution episodes." That is, air samples were collected at times when residents reported particularly strong odors or irritation. The concentrations of air pollutants detected in this study, therefore, may not be representative of average exposures for 1956-1957. Rather, they are more likely to indicate potential maximum level exposures during this time period. Furthermore, air monitoring methods for volatile organic compounds (VOCs) were not well developed in the 1950s, and have improved dramatically since then. The strict

quality control and quality assurance measures commonly used today had not been developed; therefore, the accuracy of the data cannot be determined.

For the 1956-1957 study, investigators sampled VOCs at various locations around the West End area when they received specific complaints about odor or irritation. The results of this sampling are summarized in Table 1, Appendix A. Acrylonitrile, benzene, butadiene, chloroform, xylene, and vinyl chloride were detected at levels exceeding ATSDR comparison values for both cancer and noncancer effects (Special Air Pollution Study, 1957).

The second set of data reviewed was from the 1988 UATMP that collected 24-hour air samples in Louisville (EPA, 1989a). The monitoring station used was EPA Aerometric Information Retrieval System (AIRS) code 21-111-1020, which corresponds to a site still in use by the JCAPCD, located at the intersection of Floyd and Jefferson streets in downtown Louisville (JCAPCD, 1998). (Note: This location is not within or downwind of Rubbertown, so concentrations may not be representative of that area. However, the data were examined because they are the only recent monitoring data available for VOCs in the Louisville area.) The UATMP is a screening program that is designed to assess the kinds of metals and organic compounds that may be present in urban ambient air. The UATMP sampled for VOCs, metals, and carbonyl compounds. ATSDR received and reviewed the results of the volatile organic compound monitoring program. See Table 2, Appendix A, for a summary of these results. The compounds 1,3 butadiene, chloroform, 1,2-dichloroethane, benzene, bromodichloromethane, and 1,1,2-trichloroethane were detected at levels above ATSDR's most conservative cancer comparison values. Chloroform, however, was detected in only one of 37 samples. (Acrylonitrile was not sampled for in this study.) (EPA, 1989). No compounds were detected above ATSDR's acute environmental media evaluation guides (EMEG).

Since 1980, the Kentucky Air Pollution Control District has been sampling for the six criteria pollutants of the National Ambient Air Quality Standards (NAAQS): carbon monoxide, sulfur oxides, nitrogen dioxide, lead, ozone, and particulates. The third set of data reviewed by ATSDR was collected under this monitoring program. Ozone levels have exceeded the national standard every year since the monitoring began, leading the EPA to classify Louisville as a "non-attainment" area (JCAPCD, 1998). (Note: None of the ozone monitoring stations are in the West Louisville area.) See Appendix C for further discussion of ozone. No other criteria pollutants exceeded NAAQS standards.

Soil

In 1995, a private consultant conducted limited residential soil sampling in the communities surrounding Rubbertown. Samples were analyzed for lead, arsenic, and cadmium. Results of the analyses were provided to the Jefferson County Office of Health and Environment. Three samples, each at a different depth (0-2 feet, 4-6 feet and 8-10 feet), were collected from 7 different locations. See Table 3, Appendix A, for the results of the analysis of soil from the 0-2 feet depth range (surface soil). Generally, concentrations were lower in deeper soils.

Lead was detected in surface soil ranging from 8.8-851.8 parts per million (ppm). Arsenic ranged from 1-26.7 ppm, and cadmium ranged from 1.2-4.2 ppm (Ecosolve, 1995). These data suggest that concentrations of these metals may be elevated above natural background levels in the residential area (Shacklette and Boerngen, 1984). However, the maximum cadmium concentration is below the relevant ATSDR comparison value (child chronic EMEG), and the maximum arsenic concentration is only slightly above the relevant comparison value. It should be noted, though, that because the samples were collected from

0-2 feet depths, ATSDR cannot accurately estimate the concentration in the shallowest soils (0-3 inches deep), which is the region with which people are likely to come in contact.

Sediment

In December 1995, the Kentucky Natural Resources and Environmental Protection Cabinet (NREPC) sampled sediments for polychlorinated dibenzo-p-dioxins (dioxins) and polychlorinated dibenzofurans (furans) in Chickasaw Park Lake, which is within the city limits of Louisville in the vicinity of Rubbertown. Dioxin was found in the sediments, as well as in fish (see below). The dioxin concentration, which is expressed as toxic equivalents (TEQ) of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), for the sediment sample was 4.62 parts per trillion (ppt). The TEQ average for dioxins in sediments nationwide is approximately 4 ppt (NREPC, 1996).

Dioxins are everywhere in the environment and concentrations are expected to be higher in urban areas than in rural areas as a result of human activities (ATSDR, 1997). The TEQ concentrations of dioxins detected in the sediments at Chickasaw Park Lake are well below the range of sediment guideline values (23-138 parts per billion [ppb] of TCDD) recommended by Comber et al. (1996) to prevent bioaccumulation of the dioxins in fish. In addition, the concentrations detected in the sediments are very similar to the EPA Region III risk-based screening value (4 ppt) for residential soil.

Fish

The NREPC collected fish from the Chickasaw Park Lake in Louisville in August 1995, and analyzed them for dioxins and furans. The species analyzed were carp *(Cyprinus carpio)* and white crappie (*Pornoxis annularis*); only one crappie and one carp were analyzed. The dioxin TEQ for the crappie was 2.43 ppt. Duplicate samples from the carp were analyzed, with resulting dioxin TEQ values of 13.77 ppt and 17.74 ppt.

B. Quality Assurance and Quality Control

In preparing this public health assessment, ATSDR relied on information provided in the referenced documents. While the UATMP report indicated that appropriate quality control measures were followed, it was more difficult for ATSDR to determine whether the 1956-1957 air quality study, the studies of contaminants in fish and sediment, and the soil sampling followed adequate data quality assurance procedures. Few details were provided in the summaries of these studies that ATSDR reviewed. It is likely that quality assurance and control procedures in the 1956-1957 study were not on a par with current standards; however, the 1950s' air data, while of questionable quality, are treated as positive detections of air contaminants for the purpose of this public health assessment. This study aside, ATSDR staff have no indication that adequate quality assurance and quality control measures were not followed regarding chain-of-custody, laboratory procedures, and data reporting. The analyses, conclusions, and recommendations in public health assessments are valid only if the referenced documents are complete and reliable.

PATHWAY ANALYSES

To determine whether people were or continue to be exposed to contaminants originating from Rubbertown, ATSDR evaluated the factors that lead to human exposure. These factors or elements include:

1. Source of contamination (e.g., release of contaminants through the plant stack).
2. Environmental medium in which the contaminants may be present or may migrate (e.g., groundwater, air).
3. Points of human exposure (e.g., private well water).
4. Routes of human exposure such as ingestion, inhalation, or dermal exposure.
5. A population that could be exposed (e.g., nearby residences).

Based on these factors, ATSDR identifies exposure pathways as completed, potential, or eliminated. A completed exposure pathway exists in the past, present, or future if all five elements of an exposure pathway link the contaminant source to a receptor population. Potential pathways are defined as situations in which at least one of the five elements is missing, but could exist. Potential pathways indicate that exposure to the contaminant could have occurred in the past, could be occurring now, or could occur in the future. In an eliminated exposure pathway, at least one of the five elements is missing and will never be present. The following describes only those pathways that are relevant to the site. It also includes information on eliminated exposure pathways. Please refer to Table 4, Appendix A, for exposure pathway information.

A. Potential Exposure Pathways

Air

The focus of this public health assessment is on West Louisville, the area potentially impacted by pollutants from Rubbertown industries. However, current air data are not available for this area. Previous air sampling efforts for the downtown Louisville area have detected several contaminants. ATSDR has determined that Rubbertown workers and West Louisville residents may currently be exposed, and may have been exposed in the past, to contaminants through inhalation. Only limited air data are currently available to evaluate the public health significance of these exposures. ATSDR will evaluate additional air data as the data become available.

Soil

Lead, cadmium, and arsenic were detected in soil samples (0-2 feet depth) collected from residential yards (seven samples in total) near Rubbertown. ATSDR was unable to determine the locations of these samples. Residents, including children, may potentially be exposed to soil contaminants while gardening or playing. Routes of potential exposure include dermal contact and incidental ingestion of contaminated soil, or inhalation of fugitive dust.

Fish (Past)

Dioxins have been detected in samples of fish from Chickasaw Park Lake. Residents may have occasionally caught and eaten fish from this lake in the past. Using the EPA risk-based approach[1], the NREPC concluded that fish from the lake contained unacceptable levels of dioxin and should not be eaten (NREPC, 1996). This approach is very conservative and did not determine site-specific exposures. However, as cautious public health practice, the US Fish and Wildlife Service removed all of the fish in Chickasaw Park Lake, restocked the lake, and posted it as catch-and-release fishing only (EPA, 1998).

not actually restocked. (according to Dan Balsmeier 2/22/12)

B. Eliminated Exposure Pathways

Groundwater

Twelve former and currently operating industrial sites in the Rubbertown area are under RCRA (Resource Conservation Recovery Act) corrective action, and many of these facilities have contaminated the groundwater (EPA, 1998). Residents in the Rubbertown area are provided with municipal water that is drawn from the Ohio River, and thus should not be exposed to any contaminants present in groundwater. The river intake, which is upgradient of the Rubbertown area, is at the intersection of Zorne and River Roads. The river water goes through several treatment phases, is tested for numerous chemical compounds, and is in full compliance with the EPA Safe Water Drinking Act (Louisville Water Company, 1998).

Surface Water and Sediment

Fishing and swimming are prohibited along the stretch of the Ohio River bounded by Rubbertown (downstream of the McAlpine Lock and Dam) due to the high bacterial counts and level of chlorinated hydrocarbons (EPA, 1998). Swimming is also prohibited in Chickasaw Park Lake. Therefore, it is unlikely that residents are exposed to contaminated surface waters and sediments in the Ohio River (adjacent to Rubbertown) and Chickasaw Park Lake.

Fish (Present)

Dioxins were detected in fish in Chickasaw Park Lake in the past. Because only catch-and-release fishing is currently allowed in the lake, it is unlikely that residents are exposed to dioxins through ingestion of fish caught in the lake. It is also unlikely that residents are exposed to contaminated fish from the Ohio River, as the section of the river adjacent to Rubbertown is posted against fishing.

PUBLIC HEALTH IMPLICATIONS

A. Toxicologic Evaluation

This section addresses the likelihood that exposure to contaminants at the maximum concentrations detected would result in adverse health effects. While the relative toxicity of a chemical is important, the response of the human body to a chemical exposure is determined by several additional factors, including the concentration (how much); the duration of exposure (how long); and the route of exposure (breathing, eating, drinking, or skin contact). Lifestyle factors (i.e., occupation and personal habits) have a major impact on the likelihood, magnitude, and duration of exposure. Individual characteristics such as age, sex, nutritional status, overall health, and genetic constitution affect how a human body absorbs, distributes, metabolizes, and eliminates a contaminant. A unique combination of all these factors will determine the individual's physiological response to a chemical contaminant and any adverse health effects the individual may suffer as a result of the chemical exposure.

ATSDR has determined levels of chemicals that can reasonably (and conservatively) be regarded as harmless, based on the scientific data the agency has collected in its toxicological profiles. The resulting comparison values and health guidelines, which include ample safety factors to ensure protection of sensitive populations, are used to screen contaminant concentrations at a site and to select substances (referred to as "chemicals of concern") that warrant closer scrutiny. A "chemical of concern" is defined as any chemical that is detected in air, water, soil, or biota at concentrations that exceed one or more health comparison

values. (Refer to Appendix D for a more complete description of ATSDR's comparison values, health guidelines, and other values ATSDR uses to screen site contaminants.)

When screening individual contaminants, ATSDR typically compares the lowest comparison value available, typically the cancer risk evaluation guide (CREG) or chronic environmental media evaluation guide (EMEG) for the most sensitive, potentially exposed individuals (usually children) with the highest single concentration of a contaminant detected at the point of exposure. This high degree of conservatism results in the selection of many contaminants as chemicals of concern that will not, upon closer scrutiny, be judged to pose any hazard to human health. However, ATSDR judges it prudent to use a screen that lets through many harmless contaminants rather than one that overlooks even a single potential hazard to public health. The reader should keep in mind the conservativeness of this approach when considering the potential health implications of ATSDR's toxicologic evaluations.

Chemicals of Concern in Air

During the 1956-1957 Special Air Pollution Study, acrylonitrile, benzene, butadiene (isomer unspecified), and vinyl chloride were detected in elevated concentrations. As mentioned earlier, data collected during this early study, however, may not be representative of true exposure concentrations for that time period because sampling was conducted only during "acute pollution episodes." Concentrations recorded during these episodes most likely do not reflect chronic exposure levels during the time period. Qualitatively, it is probably safe to say that exposure concentrations decreased over time because industry developed air pollution controls and EPA has established air pollution standards for toxic chemicals.

Several compounds were detected above comparison values in either the 1980-1997 Kentucky Air Pollution District sampling or the 1988 Urban Air Toxic Monitoring Program. These include benzene, 1,3-butadiene, 1,2-dichloroethane, and ozone. Chloroform, trichloroethylene, 1,1,2-trichloroethane, and bromodichloromethane were also detected above comparison values, but each in only a few samples (5 or fewer of 37 samples), and not at very high levels (only slightly above the most conservative comparison values). (See Appendix A, Table 2.) For these reasons, ATSDR did not consider these latter chemicals to be of significant health concern. Levels of contaminants detected in post-1980 air sampling events were generally lower than levels associated with acute and chronic health effects. However, it is important to note, the 1988 monitoring station was located in downtown Louisville, not in the West End area which is directly downwind of Rubbertown.

Because we do not know how representative the historical data are and, therefore, the extent to which people were exposed, ATSDR cannot fully evaluate the likelihood of adverse health effects from exposure to contaminants in the ambient air in Rubbertown. To provide some perspective to the possible exposures, Appendix C includes information on the contaminants detected in the historical data.

Chemicals of Concern in Soil

Only limited sampling data exist for contaminants in soil. Based on this limited data, lead was detected in off-site soils at relatively low concentrations, up to 851 ppm. This value is somewhat higher than lead levels in background soils of the Eastern United States, which range from less than 10-300 ppm (Shacklette and Boerngen, 1984). Although many of the homes in the area where the samples were collected likely contain lead-based paint, the source of the lead cannot be determined on the basis of the available monitoring data.

Possible sources of elevated lead levels in the environment include lead-containing automobile exhaust, industrial emissions, and lead-based paint. It is not uncommon for soils next to well-traveled roadways to contain lead levels between 30 and 2,000 ppm, and soils next to houses with exterior lead-based paint may have lead levels greater than 10,000 ppm (ATSDR, 1993b).

The Jefferson County Division of Environmental Health and Protection (JCDEHP) has an active screening program to identify children with elevated blood lead levels. In 1996, 18% of children screened in the West Louisville area were found to have elevated blood lead levels (JCDEHP, undated). Because the JCDEHP is working to address this problem through their screening program and health education efforts (i.e., providing informational pamphlets at clinics, at day cares, at hospitals to new mothers, etc.), ATSDR will not further evaluate the issue of lead exposure in this public health assessment.

Chemicals of Concern in Fish

Sampling data indicate that scavenger fish, such as carp, had the higher concentrations of dioxins with concentrations of approximately 18 ppt. Concentrations of dioxins detected in crappie from Chickasaw Park Lake were similar to median concentrations reported in the 1992 EPA National Study of Chemical Residues in Fish (EPA, 1992). Based on the limited fish sampling data, adverse health effects are unlikely if a person consumed less than eight fish meals (approximately 10 ounces per meal) per year from the lake. If a person did not eat carp, the most contaminated fish, or other species such as catfish that tend to bioaccumulate dioxins, consumption of larger amounts of fish would be safe. Because this lake is small and most likely was not fished frequently by the same person or family, ATSDR considers it unlikely that anyone regularly consumed fish from this lake.

B. Health Outcome Data

Residents of Jefferson County expressed concern that potential exposures from industrial activities at Rubbertown would result in increased incidence of cancer in the community. In particular, residents in the western section of the county believed that this area had unusually high death rates from cancer in comparison to the rest of the county. While environmental data are limited and a causal association between potential environmental exposures is not possible, ATSDR reviewed available cancer data, as well as information on biomarker research that is being conducted by the Center for Environmental Health Sciences (CEHS) at the University of Louisville. Please refer to Appendix G for a summary of this information.

C. Community Concerns Discussion

ATSDR evaluates site-specific community concerns that are gathered from petition letters and accompanying documents, site visits, and contact with members of relevant agencies and organizations. Community members have expressed particular concern regarding the link between health effects observed in the Rubbertown area and environmental exposures. As mentioned previously, insufficient data are available to fully evaluate any causal links. Specific community concerns related to the Rubbertown industrial area are described as follows:

- **Increased cancer incidence and mortality**

A review of two reports evaluating demographic and cancer statistics obtained from the Kentucky Cancer Registry collected from 1991-1994, indicated that cancer incidence was slightly higher in Jefferson County in comparison to the rest of the state of Kentucky and the United States population. In addition, cancer incidence rates for the five planning areas of Jefferson County did not differ from each other. Only the West Jefferson County planning area had slightly elevated cancer mortality rates compared to Jefferson County or Kentucky. In West Jefferson County, residents are diagnosed at a later stage of disease development and get cancers that tend to be diagnosed later. Environmental data are not available to evaluate any potential association between environmental exposures and cancer rates within the surrounding communities.

Not enough information was provided to evaluate the results of the door-to-door canvassing presented in the petition letter. However, the cancer reports conducted by the Louisville and Jefferson Board of Health should have included anyone residing in the West Jefferson County area who died of cancer between 1992 and 1994.

- **Respiratory irritation and illnesses, and eye irritation**

Ozone levels in Louisville have consistently exceeded the NAAQS standard, but not at levels as high as those generally shown to cause acute respiratory problems, aggravate asthma, and cause inflammation of the lung. ATSDR cannot rule out, however, that sensitive individuals may be affected by persistently elevated levels of ozone in Louisville air. Ozone can impair the body's defenses, making some people more susceptible to respiratory illnesses, such as bronchitis and pneumonia. Automobiles, as well as Rubbertown industries, contribute to ground-level ozone.

Other chemicals detected by the UATMP can also cause respiratory and eye illness; however, these symptoms are generally caused by exposure to these chemicals at levels much higher than those found in Louisville air in 1988.

- **Impact of pollutant releases from Rubbertown industries to air, groundwater, soil, and surface water**

ATSDR continues to compile available sampling data. To date, the air data enable limited evaluation of potential health effects. Possible effects associated with air emissions are presented above and in Appendix C. Because the representativeness of the data are uncertain, only limited conclusions could be drawn. Further air monitoring is planned for the West Louisville area; ATSDR will evaluate new data as they become available.

Facility-specific groundwater and soil impacts are not likely to directly impact community residents. Local residents do not obtain their drinking water from groundwater. Instead they are served by municipal water from the Ohio River. The extent to which contaminated groundwater, if any, is discharging to surface water is unknown. According to local officials, the municipal water supply complies with the requirements the safe water drinking act.

It is not expected that residents would come in direct contact with any soil contamination on individual industrial properties. The few available residential soil samples indicate concentrations of metals typical of urban environments. Continued routine blood lead level screening of area children is recommended.

ATSDR CHILD HEALTH INITIATIVE

ATSDR recognizes that infants and children may be more vulnerable to exposures than adults in communities faced with contamination of their air, water, soil, or food. This vulnerability is a result of the following factors:

- Children are more likely to play outdoors and bring food into contaminated areas.
- Children are shorter, resulting in a greater likelihood to breathe dust, soil, and heavy vapors close to the ground.
- Children weigh less, resulting in higher doses of chemical exposure per body weight.
- The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.

Because children depend completely on adults for risk identification and management decisions, ATSDR is committed to evaluating their special interests at the Rubbertown site, as part of the ATSDR Child Health Initiative.

Children who are most likely to be exposed to environmental contaminants related to Rubbertown include children who live in nearby homes and children who attend nearby schools. Children, particularly asthmatic children, may be particularly sensitive to air pollutants. As discussed in previous sections, not enough air data exist for evaluating whether exposures are linked to reported health concerns.

Children could have been, and could continue to be, exposed to moderately elevated lead levels in off-site soils. Eighteen percent of children screened in the West Louisville area in 1996 had elevated blood lead levels. As mentioned previously, the JCDEHP is working to address this problem. Small children are both more sensitive to the effects of lead and more likely to be exposed due to "pica" and "geophagia" (soil eating) behavior. The likely source of the lead is lead-based paint; however, ATSDR cannot determine with certainty the source of the lead.

1. This assumes that at least 8 meals of 10 ounces of fish will be eaten per year for 30 years, and that contaminant levels remained similar over the 30 year period (EPA,1989b).

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